THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

VOL. VIII.—No. 169.

POSTAL TELEGRAPHS.

DURING the last few weeks much has been said and more still written on the subject of the British Postal Telegraph Department and its duties to the public and inventors. The recently instituted law-suits against the telephone companies had already drawn considerable attention to these questions, when some remarks made in the presidential address to the Society of Telegraph Engineers acted on the public press like at Woolwich a few days since the fuse did to the already overloaded gun.

The telephone exchange system and telephony generally are gaining ground in our towns at a fairly rapid pace, and, as they progress, will inevitably extend with increasing rapidity for some years to come. As the telephone is capable of so much, and as the Postal Telegraph Department is now to some extent adopting it, it seems to us a pity that more encouragement was not given to its development at first, as there would then have been less sympathy accorded, and justly so accorded, to the telephone companies.

It is true that the Department cannot be always changing its instruments, especially if little or no advantage is to be gained thereby; but with the telephone the case is entirely different, foreshadowing as it did, and does, a new era in telegraphic communication, and not being in itself merely a modification or re-arrangement of some pre-existing species of apparatus.

With the transference of the businesses of the various telegraph companies to the Post Office grave responsibilities were created for those in authority at St. Martin's-le-Grand. Amongst them may be mentioned the cherishing of inventions which previous competition had effected, and also the giving to the public the utmost practicable facilities for telegraphic intercommunication.

Perhaps it is an inevitable consequence of so sweeping a change that some must suffer, and undoubtedly the manufacturers of instruments have had a bad time, and several of the smaller makers have been utterly swept away. With inventors, however, if the advance of the science is not to languish or cease in this country, it is necessary that they should have the utmost latitude allowed them to experiment, and moreover they should have practical and substantial support as soon as the utility of their experiments has been clearly demonstrated.

We do not think inventors will complain much of the treatment they receive at the hands of those in power at the G.P.O., nor do we think that public business is to be much improved except in the important matter of rates generally, and in improved means of communication in suburban and outlying districts; but both inventors and the telegraphic service will be benefited if the rigour of the economy forced on the Telegraph Department by the public itself is got rid of. It is by no means necessary that the telegraphs should pay a dividend, and we are glad to perceive public opinion has at last, as it frequently does, swung completely round, and is now calling for those advantages which will necessitate increased expenditure, and which expenditure it has hitherto strongly deprecated.

It is to be hoped that in the near future the Post Office administration, now that public opinion has manifested itself so unmistakably, will see its way to a more liberal support of inventors, and also to an increase in facilities for the telegraphing public, in the direction we have indicated, even perhaps to a considerable reduction of rates; for what matters it the spending of a few hundred thousands on more instruments and lines for increased traffic if the public are the gainers to a still greater extent by the better communications afforded, and although the Department might then show a deficit instead of, as now, a slight surplus?

But it is certain that neither of these changes can be made unless the Government will consent to the increase of expenditure, and it is rather in this direction that the public must agitate than cast obloquy upon those who in no way deserve it.

Surely we are not so poor or puny a nation that we cannot allow pecuniary reward to inventors and pecuniary support to a department which can and must be maintained—the first, the most complete, and the most enterprising of its kind in the whole world.

THE BERLIN ELECTRICAL RAILWAY.

IN a recent number of *La Nature*, M. E. Hospitalier has given a description of the apparatus employed on this railway. Referring to the heading of the article, viz., "The Electric Traction of Aerial and Subterranean Railways in Large Towns," he says:—"The title of this article is of a nature likely to produce incredulity in our readers, even amongst those who are familiar with the recent marvels of electricity. In truth, a similar idea conceived twenty years ago, would have assuredly only brought down a

storm of sneers on the heads of those who had dared to suggest it; but the discoveries which have taken place since that time have rendered the question worthy of serious consideration, inasmuch as it has been shown lately in the capital of the German empire to be quite practicable.

"The electric railway of Berlin, which has worked during the whole of the Exhibition of 1879, is merely an application of *the transmission of motive power to a distance by electricity*; we will now explain the principle of the apparatus in a few words.

"If we connect the magneto-electric, or dynamo-electric machines, A and B, by metallic conductors, and we cause one machine to be moved by power, the electricity generated will cause the other machine to rotate with a nearly corresponding amount of power.

"It is clear that the machine, B, will only rotate with but a portion of the power generated by A, and

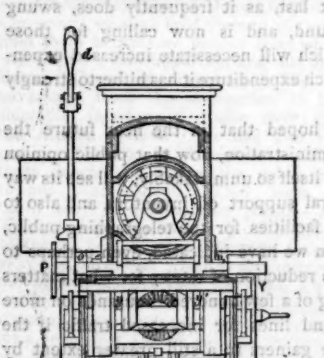


FIG. 1.

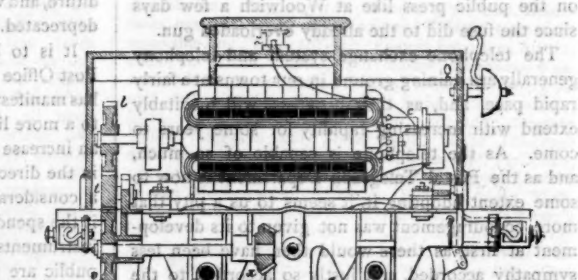


FIG. 2.

that the relation between the work given out and the work produced will vary according to the nature of the machines, their relative velocities, their power, and the length of the conductors which join them; in certain cases the power utilised is as much as 60 per cent., and even with conductors of great length it seldom falls below 30 per cent.

"If we take a dynamo-electric machine of ten horse-power force, turned by a steam engine, and we connect it by conductors to a second dynamo machine placed on a car, the wheels of which can receive a movement for this second machine, we shall have thus constituted an *electrical carriage* which will work so long as continuity is kept up with it by means of the conductors.

"In placing our carriage on rails and utilising, on the one hand, these rails so as to form one of the conductors connected with the machine by the medium of the wheels, and on the other hand, a central rail well insulated so as to form the second conductor, and conveying the current to the machine by *brushes* always in contact with the rail we shall then have an *electric locomotive* receiving the motive force under the form of electricity, and able to exercise an amount of work varying from three to six horse-power. By attaching small carriages to this locomotive, we have the electric railway which Dr. Werner Siemens, the eminent electrician, has established at Berlin.

"Figs. 1 and 2 show end and side sectional elevation of the locomotive drawn to $\frac{1}{10}$th scale.

"The dynamo machines employed are those of the Siemens pattern, working with continuous currents; both the generating and working machine are of the same dimensions.

"The machine is shown in side sectional elevation by fig. 2; on this fig. is seen a longitudinal section of the bobbin which, set in motion by the electric current, transmits its movements to the driving-wheels by a series of cog-wheels, *l*, *t*, *v*, *x*, *y*. This train of wheels is necessary in order to make the velocity of the wheels less than that of the bobbin, and to conveniently arrange the whole of the apparatus.

"The generating machine has one of its poles connected to the rail of the railway, and its other pole connected to the central rail, N (figs. 1 and 2), formed of an iron bar on a well insulated support. A pair of brushes formed of fine copper wires, like the Gramme machine collectors, rub constantly against the central rail, N, and establish continuous electric communication between one of the poles of the machine placed on the locomotive and the rail. The current arrives then by the rail and the brushes, traverses the wires of the dynamo machine placed on the locomotive, and returns to the source of electricity by the wheels and the ordinary rails.

"The carriages are metallically connected to the locomotive, so that their wheels establish a more perfect communication than could be obtained from the wheels of the locomotive alone. The cutting off and putting on of the current is effected by an ordinary switch, which can be worked by the left hand of the engine driver whilst his right hand controls the brake. Experiments made with a train of

this description carrying 18 passengers, showed that a velocity of 1·88 metres per second could be attained, this being represented by an effective horse-power equal to two, without counting the work expended in moving the locomotive itself. In the Exhibition building the speed marked was 3·50 metres per second (12·6 kilometres per hour), the work developed being equal to 3½ horse-power."

Recently at the general meeting of the new Electro-Technic Society—a body rapidly assuming importance among the philosophical associations of the German capital—the Postmaster-general, Stephan, presiding, Dr. Werner Siemens made a most interesting statement upon the impending construction of an electric railway. Fifteen feet above the pavement he proposes to construct a network of electric lines, intended to convey passengers from the various stations of the new metropolitan line to all parts of the capital. To work these lines with ordinary locomotives would be impracticable, unless, indeed, the pillars on which the metals would have to be placed were very solid and of a nature not to interfere with the traffic of crowded streets. The electric railway required no such heavy structures, the moving power being the new dynamo machine, invented by the speaker, and perfected by Herr von Hefner, one of the leading engineers of his firm. For its working capacity the machine was indebted to a very simple contrivance. By revolving his machinery in the direction opposite to the current he had not only obviated reduction of force, but actually augmented its strength. This theory, which was communicated by him 13 years ago to the Berlin Academy, had since been applied by Dr. Siemens and his associate, Herr von Hefner, to the construction of an electro-dynamo engine, whose perfect working capacity was tested in the electric railway of the Berlin Industrial Exhibition of 1879. The machine was so very powerful that the chief difficulty in perfecting it had been to prevent its destruction by its own inherent force. The action of the machine, too, was cheaper than that of the locomotive: a train consisting of machine and passengers' carriage could be profitably run on his viaduct railway if there was an average of five travellers. Considering that the electric viaduct admitted of being placed on slight and elegant columns, it was obvious that this new species of railway supplied a ready means of freeing the streets of crowded capitals from the excessive traffic now obstructing them. He was not prepared to say that the new invention would supersede locomotives for long distances, a dynamo machine in connection with the engine requiring to be put up every twenty miles; but as its applicability for short distances had been absolutely proved, omnibus and tram were clearly destined to become obsolete very shortly, and metropolitan communication would be conducted upon a new and highly improved plan. In conclusion, the speaker hoped that Berlin would be the first city to adopt this promising contrivance.

Dr. Siemens then discussed the feasibility of employing his engine for increasing the traction power of locomotives in overcoming ascents too steep to admit of the requisite friction of the wheels. He also showed that the Berlin postal *trabes*, in which letters are conveyed by compressed air, might be more advantageously worked with his dynamo machine.

EFFECTS OF A THUNDERSTORM ON A TELEGRAPH LINE IN NEW ZEALAND.

By W. H. FLOYD, M.S.T.E., Superintendent of New Zealand Railway Telegraphs.

ON the afternoon of the 11th of November, this year (1879), a violent thunderstorm was experienced on the Malvern branch of the New Zealand system of railways in the Middle Island, and considerable damage resulted to the railway telegraph line between Darfield Junction and Hawkins Stations.

Nine telegraph poles were more or less damaged, and six of them were so badly shattered and splintered as to be no longer serviceable; the remaining three, although considerably shaken, were good enough to be refitted and continued in use as telegraph poles. The damage to poles extended over a straight line of three-quarters of a mile in length, but all the poles in that length were not injured.

Commencing three-quarters of a mile from Darfield Junction, the first pole was badly shattered, and only about a third of it left standing, the other two-thirds being split up into small fragments and scattered about. The next pole towards Hawkins Station was perfectly sound. The third was as badly injured as the first, but the fourth and fifth were uninjured. The sixth, seventh, and eighth were badly shattered and splintered from their tops to the ground-line.

Between the seventh and eighth poles, at about the centre of the span, and also at about midway between the first and the last pole injured, the telegraph wire of No. 8 gauge was fused and parted, and over the whole of the 21 feet distance between the line of wire and the railway metals the ground showed signs of disturbance. Three railway sleepers were shattered, and between one of them and the line of wire there were two strongly-marked paths, resulting from the storm. The paths were joined just at the sleeper, but divided almost immediately, and remained distinctly separate until they disappeared altogether—six feet apart—directly under the line of telegraph wire. It appeared as though there had been an independent path made between each separated end of the fused wire and the railway metals.

The paths were tunnelled part of the way to a depth of from twelve to fifteen inches underground, and to a diameter of about five inches, and part of the way they were cut to a depth of from four to five inches from the surface. The earth thrown up at the sides of the surface cuttings exhibited, in patches, a greyish colour that suggested the idea of its having been under the influence of fire.

The ninth pole had only a piece of its top splintered off, and could be refitted. Between this pole and the railway metals there was a single path, partly tunnelled and partly cut from the surface, as previously described. In both cases the disturbance of the ground was greatest near the railway metals, and gradually decreased until it ceased altogether under the line of telegraph wire. The tenth pole was only slightly shaken near the ground-line. The eleventh had a slice two inches thick cleanly taken from under its arm to the ground-line, and the slice was splintered into matchwood. The next three poles were uninjured, and the signs of damage ceased altogether at the fifteenth pole, which was

badly shattered. None of the poles were provided with lightning conductors.

At the Darfield Junction telegraph office the station-master and telegraphist were seated writing, when they saw a bright light apparently leap from one of the instruments to the floor, and heard a noise like the report of a fowling-piece.

The instruments remained in working order, but it was afterwards found that the local contacts of a Siemens polarised relay showed signs of the lightning. Part of the surface of the platinum contact piece on the armature was fused, giving the appearance of a circular space about one-eighth of an inch in diameter having been tooled out of it in a lathe, except that the bright surface inside the circle had minute glistening feathery particles of platinum left on it; and the platinum point, with which the piece on the armature makes contact to complete the local circuit, had a roughened and discoloured appearance, due to its surface having been fused.

The glass top on the relay was also spotted just above the local contacts with innumerable dots that had a bright metallic appearance under a magnifying glass. These spots were much brighter and more clearly defined on the inner than on the outer surface of the glass top of the relay.

The Darfield Junction office was fitted with Siemens grooved-plate lightning guards, placed between the leading-in wires and the instruments.

UTILISATION OF THE TIDES.

As we pointed out in a recent number of the *Journal* (Oct. 1st, 1879), the solution of the problem of the transmission of motive power to a distance by means of electricity is likely to prove of the highest importance in enabling that inexhaustible source of power—the tide—to be utilised. The scientific world, up to the present, has shown but little signs of a determination to fairly grapple with the general problem, and it is only by a fitful attempt now and then that the matter is drawn attention to. It is possible that the difficulties in the way have up to the present seemed so insurmountable that any attempts to deal with the subject have been considered to be mere waste of time; but, still, now and then we hear of the question being discussed. Recently, an excellent paper was read before the Liverpool Engineering Society, by Mr. Arthur Oates, on "The Utilisation of the Tides," in which some simple calculations were given which placed the matter in a very clear light and which are highly interesting. The following are Mr. Oates' calculations:—

APPROXIMATE TABLE

Showing the power and value of the vertical motion of tides per square mile, if a little over 25 per cent. of the latent power is utilised.

Range in Feet.	Horse-power of a square mile.	No. of sq. yds. of sea surface which produce 1 H. P.	Value of a square mile per year.	Allowable capital to be sunk in utilising works per square mile.
			£	£
5	469	6,605	1,172	5,860
10	1,877	1,650	4,692	23,460
15	4,223	733	10,557	52,785
20	7,509	412	18,772	93,860
25	11,733	264	29,332	140,660
30	16,895	183	42,237	211,185

Explanation.—The first column of this table gives the range, which may be taken either for that of mean or of neap tides; six different ones are selected for these calculations, every five feet, from five to thirty, which will include all the most common tides on our coasts. The second column gives the horse-power per square mile; this is obtained by multiplying 27,878,400—the number of square feet that a square mile contains—by the range, which will give the cubic feet of water moved by each tide per square mile; this divided by 35—the number of cubic feet of sea-water which weighs a ton—will give its weight in tons. This falls on an average half the range *nearly* four times per day; but as a little over 25 per cent. of the actual power being utilised is only reckoned, the weight of water moved per square mile is multiplied by half the range once only; this gives the feet tons of power per day of 24 hours, and divided by 21,214·3—the number of feet tons a horse-power equals per day of that length—will give the horse-power of a square mile. 3,097,600, the number of square yards a square mile contains, divided by the horse-power of a square mile, will give the number of square yards it will take to produce one horse-power, which is given in the third column. As about half a hundredweight of coal is consumed per day of 24 hours for each indicated horse-power of a steam engine, twopence—the value of that quantity of coal—is taken as the value of a horse-power per day of 24 hours. If the tidal power is only required during a portion of the day the remainder could be stored, therefore all the power utilised during the 24 hours may be reckoned as saleable, but only 300 days per year are so reckoned. The value of a square mile per year is obtained by multiplying the horse-power first by 2, then by 300, which gives it in pence, and this divided by 240 will give the value in pounds, as shown in the fourth column.

The fifth gives the amount of capital that may be sunk in utilising one square mile; this is obtained by multiplying its value per year by 5, which gives the amount of capital that would produce, at 20 per cent., interest of the same value, this will allow 15 per cent. for expenses, and a dividend of 5, or, if the expenses only took 10 per cent., a dividend of the same amount could be paid.

This table, as its name implies, gives only approximations to the true amounts; but it will probably be found to err in under, rather than over, estimating the value of tides.

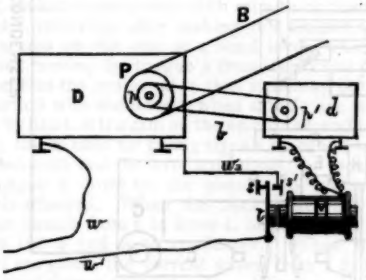
The power and value of any tidal inlet can be roughly calculated, by multiplying or dividing—according to its size—the amounts given in the table opposite the required range by the area of the inlet. And by estimating the probable cost of the utilising works, and comparing it with the "allowable capital," an idea may be formed of the probable financial success of the undertaking. In ascertaining the area of a tidal inlet, allowance should be made for the beach and banks uncovered at low water, and also for the quantity of fresh water flowing into it if great in proportion to the size of the inlet, otherwise the power and value calculated from the table will be too great. If the beach and banks are of a uniform gradient between high and low water marks, the area of the water at half tide may be taken as the true superficies of the inlet. The third column will be found of use in

calculating the area required to produce a given amount of power at a given range.

Mr. Oates has pointed out that one of the difficulties in utilising the tidal force consists in the adoption of an efficient system of storage of the power; this difficulty, he mentions, may be overcome by storing the force, in the form of water decomposed into its constituent elements by electrical decomposition, the electricity being generated, of course, by a dynamo machine worked by the tidal power.

ZANNI'S PATENT MAGNETIC CUT OFF FOR DYNAMO-ELECTRIC MACHINES.

THE object of this invention is to prevent a reversal of the polarity of the electricity employed in the process of the electro-deposition of metals and generated by means of dynamo-electric machines. It is a well known fact that in the process of depositing metals by means of an electric current generated by a dynamo machine, that whenever the machine ceases to work a current generated by the action of the electrodes in the depositing bath returns through the dynamo machine and reverses its polarity, consequently when the machine is again started the metal deposited on the article being plated becomes, by a reversal of the required process, denuded of its metallic coating instead of having the thickness of the same increased. Several devices have been suggested and tried for overcoming this defect, but most of them, for some cause or other, have been unsatisfactory and uncertain in their action. The invention of Mr. Zanni



for effecting the object in view has been tested and proved to be thoroughly reliable in its action, and is therefore a very useful addition to the electro-plater's plant.

The principle of the invention is shown by the fig.

D is the dynamo machine driven by the band B, which is connected with the source of power. On the same axle to which the driving pulley, P, of the machine is fixed, is also attached another pulley, p, which drives by means of a band, b, and pulley, p', a small magneto machine, d; the circuit of this machine is closed through the electro-magnet, M. The armature, t, of the electro-magnet normally rests against the insulated stop, s; but when the magnet is excited it is attracted against the stop, s', thus completing the circuit of the wires, w, w', which lead to the depositing bath through the connection, w_2.

The action of the apparatus is almost self-evident: when the machine is at rest the circuit of w, w' is open, but when the dynamo machine, D, is rotated and with it the magneto machine, d, the current from the latter at once excites the electro-magnet, M, and attracts the tongue, t, against the stop, s', thus closing the circuit of w, w'; the moment the machine stops, the tongue, t, falls back against the stop, s, thus opening the circuit and preventing the return of the current from the depositing bath through the machine, D.

In the number of the *Journal* for December 15th, 1879, in a notice of Mr. Urquhart's book on electro-plating, we expressed our surprise that a simple form of rheostat had not been adopted in electro-plating operations for the purpose of regulating the strength of the current; on reference to a patent of Mr. Zanni's we find that this has been suggested and patented by him together with the use of a galvanometer in the circuit, by which the current strength could be seen.

Although fully recognising the efficiency of Mr. Zanni's magnetic "cut off," we should have thought that the same end could be effected in a simpler manner by working the electro-magnet, M, by a "derived" circuit from the machine, D, the resistance of the electro-magnet being sufficiently high to avoid drawing off more of the current than is actually required to excite the electro-magnet. The amount of current required to excite M, it is evident, would be but an infinitesimally small portion of the total current, and would therefore in no way diminish the efficiency of the machine.

MACHINERY AND APPARATUS EMPLOYED IN THE LAYING OF THE NEW MARSEILLES-ALGIERS CABLE.

II.

Electrical Testing Apparatus.

THE testing arrangements employed during the laying of a cable are of great importance, as upon their proper management depend the early discovery and accurate localisation of any fault which may occur during the submerging operation. It is very essential that the means adopted should be such as will enable both the ship and shore to notice when a fault takes place, so as to enable them to make accurate comparable measurements to localise the defect. The method adopted by the Silvertown electricians, and employed on board the *Dacia*, is one of the best systems, and has been used with great success on most of their cable expeditions; the principle of the system is shown by figs. 1 and 2, fig. 1 being the arrangement on board ship, and fig. 2 the arrangement on shore.

The end of the cable on board the ship is well insulated and connected through a Thomson galvanometer with a battery of about 200 cells. On shore a condenser is provided, one terminal of which is connected to a brass lever which plays between two insulated contacts; one of these con-

tacts is connected to the second terminal of the condenser, which latter terminal is also connected, through a Thomson galvanometer, to earth; the other contact is connected to the conductor of the cable. The battery connected to the cable on board the ship charges the former to a certain potential, and the value of this potential will be the same throughout the whole length provided no fault exists. If the lever on shore be moved against the contact connected to the cable a portion of the charge in the latter will rush into the condenser and will charge up the set of plates to which it is connected to the same potential as the cable; the second set

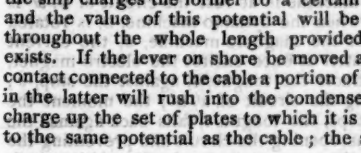


FIG. 1.

The rush of the charge into the condenser when the latter is connected to the cable contact, produces a simultaneous rush into the cable from the battery on the ship, and as this takes place through the galvanometer on board the ship a sudden throw is produced on the needle. Now if a fault occurs during the laying, the *steady* deflection on the ship's galvanometer, which is due to the flow of current through the dielectric of the cable, and which is distinct from the *throw* which takes place when the condenser becomes connected to the cable at the shore end, becomes greatly increased and renders the presence of the fault

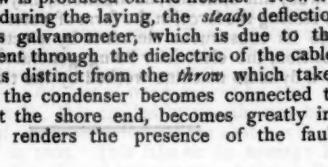


FIG. 2.

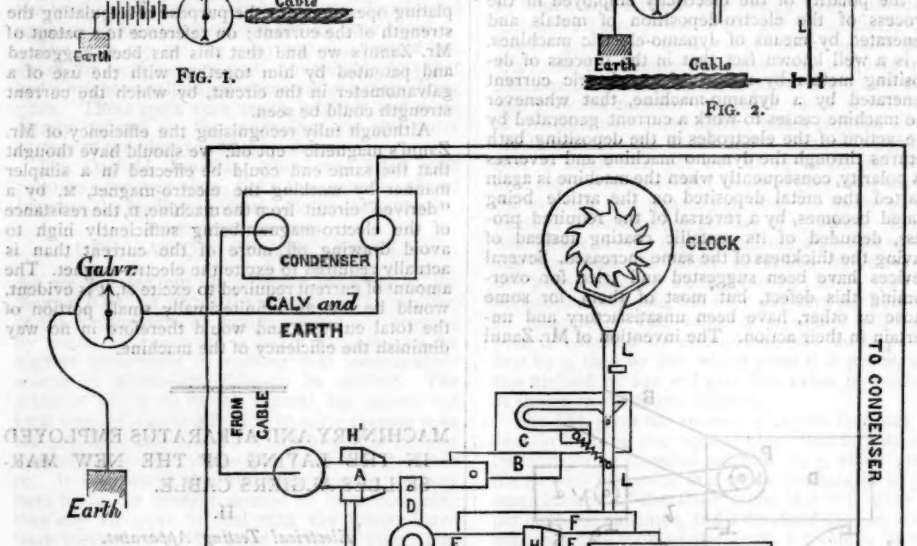


FIG. 3.

of plates will become charged to the opposite potential by a charge rushing in from earth through the galvanometer; this in-rush will produce a *throw*, or momentary deflection of the needle, the amount of which will represent the potential of the charge in the condenser, that is, the potential at the end of the cable. If now the lever be moved from the cable contact to the contact connected to the condenser, the latter will be short-circuited and discharged.

evident immediately. On the shore the effect of the fault is to reduce the potential at that end of the cable, and consequently the charge which the condenser takes becomes correspondingly reduced; when then the condenser becomes charged through the galvanometer a reduced throw is produced which thus shows the shore the existence of the fault.

The lever on shore which charges and discharges

the condenser is moved by clockwork which causes it to act every five minutes, so that every hour twelve throws are observed on each galvanometer. At the end of every hour the ship reverses the battery so that the direction of the throws is changed.

In order to enable the ship to communicate with the shore, instructions are given that if at the end of the hour the throws do not become reversed, or if they become reversed before the expiration of the hour, it is a sign that the ship wishes to communicate with the shore; in this case, then, the shore disconnects the cable from the clock lever and connects it with the speaking apparatus, and as the ship does the same, the necessary communications can be carried on. If, on the other hand, the shore wishes to call the attention of the ship he can do so by moving a lever corresponding to the clock lever two or three times quickly by hand; the ship then observing that the throws on her galvanometer take place quickly, instead of at intervals of five minutes, immediately joins up her speaking apparatus, and thus communicates with the shore.

As it is advisable that the operation of disconnecting the cable from the clock lever contact and connecting it to the hand-worked lever shall be done without difficulty, the arrangement of the apparatus is such that this can be performed with great facility.

The whole of the arrangement is shown by fig. 3. A is a brass tongue, whose normal position, while the clock-work is in operation, is on contact plate B; this plate is connected with the plate C, which plate is also connected by a small spiral spring with the lever L, L. D is a contact plate which is free while the clock is working. E, E is a brass tongue which in its normal position is in contact with the piece G. To the contact plate F the cable end is attached, and to G the condenser is connected. The lever L, worked by a ratchet-toothed wheel connected to a clock, makes contact every fifth minute on the contact at F, returning, after making this contact, to G. H' is a cam on the end of a hand lever, which is used for moving the tongue A from its normal position on B to the contact at D, thus switching out the connection with the lever L when signals are to be given by hand. H is a cam on the end of a second hand lever; this is used for giving signals by hand (when the clockwork and the lever are cut out), by pressing the tongue E down on the plate F, to which the cable is attached. When the clock is at work the current passes from F to lever L, on to plate C, and thence *vid* B and A to condenser. When hand signals are given, the current passes from F to E, D and A, and thence to condenser. When E returns to normal position at G the condenser is discharged.

In order to render the motion of the lever, to or from a contact, quick and decided, the bent spring on the plate C is provided; this has a conical piece at its end which presses against a pin on the lever; as the lever moves under the action of the clock wheel, the pin acts against the inclined side of the conical piece, and moves it until the apex is reached and passed, when the action of the spring immediately drives the lever over sharply against its contact. A similar action takes place when the lever moves in the reverse direction. The amount of play given to the springs at the end of the lever L is such that they do not break contact from F or G, as the case may be, until the point is passed at which the lever is thrown sharply over.

TELEGRAPHIC APPARATUS IN USE IN THE BRITISH POSTAL TELEGRAPH DEPARTMENT.

III.

THE BRIGHT'S BELL INSTRUMENT.

THIS form of instrument was patented by Mr. C. Bright (now Sir Charles Bright) in 1853, and was almost exclusively used by the "Magnetic" Company, it having superseded the Magnetic Needle instrument of Henley and Foster.

The instrument is an "acoustic" one, that is to say, it gives signals by sound, like the single needle instrument fitted with the Neale acoustic dial. To this latter form of apparatus indeed it is closely allied, inasmuch as the two forms are worked and read from in identically the same manner.

The apparatus consists of three parts, viz., "the Tappers," "the Relay," and "the Bells."

"THE TAPPERS."

Either of the two forms of tappers which are used in the "Single needle" instrument and which are fully described in Articles I. and II., can be used with the Bell instrument; the way, however, in which they are connected up to the apparatus differs slightly from the method employed with the single needles.

In the latter form of instrument the portion of the apparatus from which the signals are read, that is to say, the "Dial," is equally affected by the outgoing and the incoming signals; in the Bell instrument only the incoming signals or currents work the acoustic signalling apparatus, the outgoing signals pass direct to line without working the latter.

The way in which the connections are made in order to effect this result is shown by fig. 14, which represents the ordinary form of tapper keys joined up in circuit with the rest of the apparatus. Referring to this figure, it will be seen that in the key the terminals X and Y, which for the single needle instrument are kept connected together by means of a brass strap (seen in fig. 1, Art. I.), are in the Bell instrument connected to the D and U, that is, the "Down" and "Up" line, terminals of the receiving portion of the apparatus; the strap being of course disconnected from X and Y. The other connections are precisely similar to those shown in fig. 2 (Art. I.), which represented the connections for the single needle instrument; that is to say, the battery is connected to terminals Z and C, the "Up" line is connected to A, and the "Down" line is connected to T through a single needle dial, S N, which dial is now attached to all of the Bell instruments, in order to enable the signals to be read visually if necessary.

Action of the tapper.

As regards the transmission of signals the action of the tapper and the course of the current is identical with that in the case of the single needle instrument, viz., when the left-hand pedal is depressed, then the Zinc pole of the battery becomes connected to the block, *h*, and thence by the end of the spring, *v*, to the cock, *f*, thence to terminal A and on to the "Up" line of the circuit. The Copper pole of the battery being in connection with the block supporting the spring, *s*, *s*^{1}, becomes con-

nected with the projecting piece, *t*, and thence through the left-hand hinge block with the terminal T, and from there through the dial, S N, to the "Down" line.

If the right-hand pedal be depressed, the Zinc pole of the battery becomes connected with the cock, *g*, through the end of the spring, v^1, thence with terminal T, and through the dial, S N, with the "Down" line. The Copper pole, C, becomes connected through the end of the spring, s^1, with the prolongation, t^1, thence through the right-hand hinge block with terminal A and the "Up" line; thus the direction of the current is reversed.

When signals are being received on the instrument from another station, then the course of the current, supposing it to enter from the "Down" line, will be as follows:—From the "Down" line through the dial, S N, to the terminal T, thence through the left-hand hinge block and the tongue, *t*, to contact block, k, from there it passes by X to terminal D of the receiving portion of the apparatus,

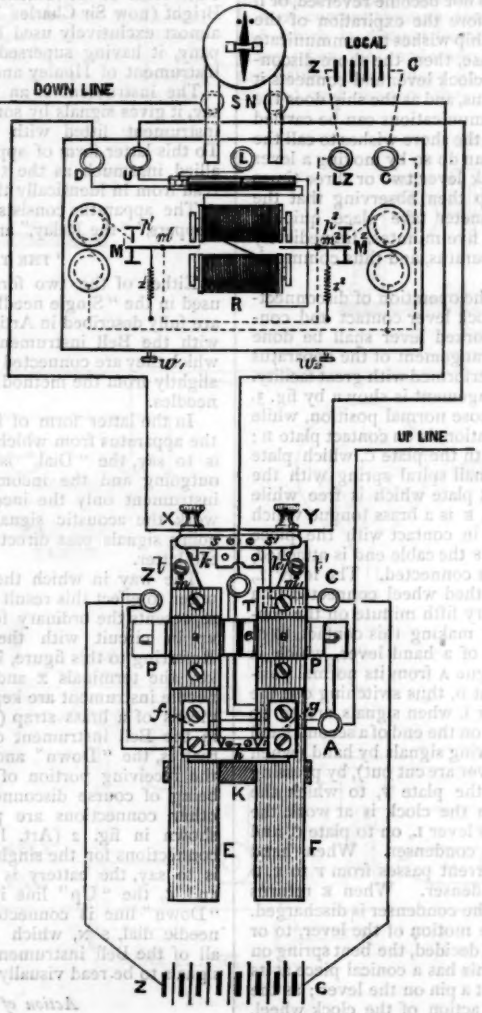


FIG. 14.

thence through the electro-magnet, R, and out at terminal U to terminal Y of the tappers; from thence it goes to k' and by the tongue, t^1, through the right-hand hinge block to terminal A and the "Up" line. Thus the outgoing currents pass through S N only, and the incoming currents through S N and through the electro-magnet, R.

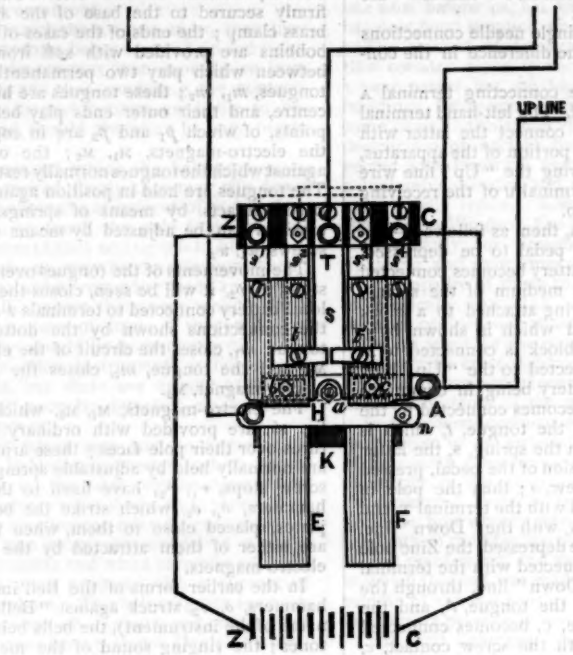


FIG. 15.

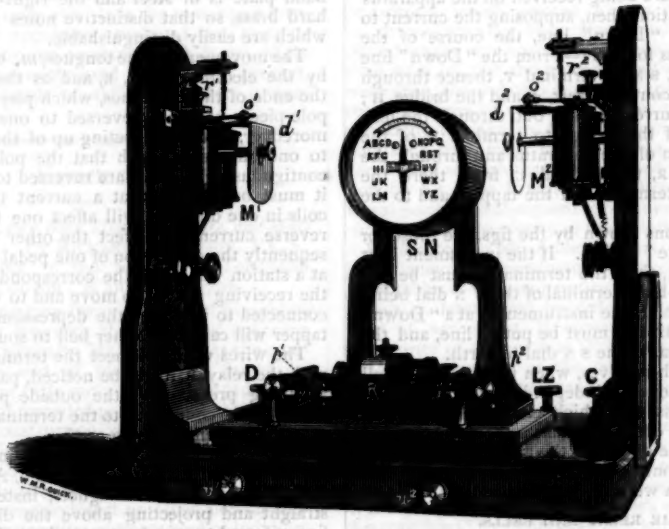


FIG. 16.

The connections for HIGHTON'S "TAPPERS" are shown by fig. 15.

As compared with the single needle connections shown by fig. 8, Art. II., the difference in the connections is as follows :—

The short piece of wire connecting terminal A with the nut, *n*, is removed. The left-hand terminal of the bridge, H, is used to connect the latter with terminal D of the receiving portion of the apparatus, and terminal A, besides having the "Up" line wire connected to it, has also terminal U of the receiving apparatus connected thereto.

The *action of the tappers* is, then, as follows :—

Supposing the left-hand pedal to be depressed, then the Zinc pole of the battery becomes connected to terminal A through the medium of the spring, s^1, the screw, *b*, and the spring attached to a block underneath the pedals, and which is shown by *g*, fig. 7, Art. II. ; this latter block is connected to A. The Zinc pole is thus connected to the "Up" line. The Copper pole of the battery being in communication with the spring, s^2, becomes connected by the medium of the latter with the tongue, *t*, which is now in communication with the spring, S, the latter having been, by the depression of the pedal, pressed away from the contact screw, *a* ; thus the pole in question becomes connected with the terminal T, and thence through the dial, S N, with the "Down" line.

If the right-hand pedal be depressed, the Zinc pole of the battery becomes connected with the terminal T, the dial, S N, and the "Down" line, through the medium of the spring, s^3, the tongue, t^1, and the spring, S. The Copper pole, C, becomes connected through the spring, s^4, with the screw contact, *c*, and thence by the spring underneath the pedals with terminal A and the "Up" line ; thus the direction of the current is reversed.

When signals are being received on the apparatus from another station, then, supposing the current to enter from the "Down" line, the course of the current will be as follows :—From the "Down" line through the dial, S N, to terminal T, thence through the spring, S, to contact screw, *a*, and the bridge, H ; from there the current passes out through the left-hand terminal of the bridge to terminal D of the receiving portion of the apparatus and through the electro-magnet, R, to terminal U, from there the current goes to terminal A of the tappers and to the "Up" line.

The connections shown by the figs. are those for an "Intermediate" station. If the instrument is at an "Up" station, then the terminal A must be put to earth, the left-hand terminal of the S N dial being connected to line. If the instrument is at a "Down" station, the terminal A must be put to line, and the left-hand terminal of the S N dial to earth.

The tappers, themselves, when used for the Bell instrument are covered independently by a wooden case with a glass top, which encloses all but the front part of the ebonite pedals ; they are screwed down to the table on which the apparatus is placed, and are set in front of the receiving portion of the apparatus, which we shall now consider.

"THE RELAY AND BELLS."

The receiving portion of the apparatus is shown in general plan by the upper portion of fig. 14, and in perspective by fig. 16.

The relay, R, which is actuated by the incoming current, consists of two electro-magnet bobbins firmly secured to the base of the apparatus by a brass clamp ; the ends of the cases of each of these bobbins are provided with soft iron pole pieces, between which play two permanently magnetised tongues, m_1, m_2 ; these tongues are hinged at their centre, and their outer ends play between contact points, of which p_1 and p_2 are in connection with the electro-magnets, M_1, M_2 ; the other contacts, against which the tongues normally rest, are insulated. The tongues are held in position against these insulated contacts by means of springs, z_1, z_2, whose tensions can be adjusted by means of the thumb screws, w_1, w_2.

The movements of the tongues over to the contact stops, p_1, p_2, it will be seen, closes the circuit of the local battery connected to terminals Z and C through the connections shown by the dotted lines ; the tongue, m_1, closes the circuit of the electro-magnet, M_1, and the tongue, m_2, closes the circuit of the electro-magnet, M_2.

The electro-magnets, M_1, M_2, which are seen in fig. 16, are provided with ordinary hinged armatures over their pole faces ; these armatures, which are normally held by adjustable springs against the screw stops, r_1, r_2, have fixed to them the small hammers, o_1, o_2, which strike the bells, or rather plates, placed close to them, when the armatures are either of them attracted by the action of the electro-magnets.

In the earlier forms of the Bell instruments the hammers, o_1, o_2, struck against "Bells" (hence the name of the instrument), the bells being of different tones ; the ringing sound of the metal was, however, found to be objectionable, and metal plates were substituted which give out "dead" sounds : these are very satisfactory to read from. The left-hand plate is of steel and the right-hand plate of hard brass, so that distinctive notes are given out which are easily distinguishable.

The movements of the tongues, m_1, m_2, are effected by the electro-magnet, R, and as the polarities of the ends of these tongues, which play between the pole pieces of R, are reversed to one another, and, moreover, as the connecting up of the two bobbins to one another is such that the polarities of the contiguous pole pieces are reversed to one another, it must be evident that a current traversing the coils in one direction will affect one tongue, and a reverse current will affect the other tongue ; consequently the depression of one pedal of the tappers at a station will cause the corresponding tongue at the receiving station to move and to work the bell connected to it, whilst the depression of the other tapper will cause the other bell to sound.

The wires which connect the terminals, D and U, with the relay, R, it will be noticed, pass through the lightning protector, *l* ; the outside portion of this protector is connected to the terminal L, by means of which it can be put to earth.

The single needle dial is similiar in construction to that shown by figs. 3, 4, 5, and 6, Art. I., but the inducing permanent magnets, instead of being straight and projecting above the dial, as in the figs. referred to, are bent round, so that the whole can be covered with a round brass case, as in fig. 16.

Faults.

Although there are several moving parts in the

Bell instruments, yet the faults to which the latter are liable are not numerous.

The screws on which the tongues, m_1, m_2, turn, may cause faults either from being screwed up too tight, so as to prevent the tongues from moving, or from being too loose, and thus rendering the contacts uncertain. The magnet bobbins are liable to become shifted, and should therefore be very firmly clamped down.

If the plates against which the hammers, o_1, o_2, strike are not screwed firmly they may slip down after a time, and allow the armatures of the electro-magnets, M_1, M_2, to touch the pole faces, this will cause the armatures to stick and signals to be missed.

The tongues, m_1, m_2, may become demagnetised; this can be ascertained by removing them, and seeing whether they will support their own weight when touched against a piece of iron; if they will not bear this test they should be re-magnetised.

The Bell, like other instruments, is liable to a variety of faults, but these are usually of such a nature as can at once be detected, since all the parts are easily got at.

The only fault which may not be apparent, is contact in the lightning protector—which short-circuits the relay, R; this fault may be detected by connecting the battery wires direct on to terminals D and U and seeing whether the relay tongues respond.

The coils of the relay are wound to a total resistance of 200 ohms, and when carefully adjusted the tongues will work properly with a current of about 3·3 milliwebers. The bell magnets are each wound to a resistance of 40 ohms, and give a good sound with a current from a 10-cell Daniell battery. The coils of the single needle dial have a total resistance of 200 ohms, and the needle should deflect up to the stops with a current of 3·3 milliwebers.

The number of Bell instruments in use in the postal service is over 250. It is the most rapid form of hand-worked apparatus employed, but from its somewhat complicated construction it is not likely to be more extensively used than it is at present, though in the hands of skilled operators it does excellent work.

Reviews.

Lightning Conductors, their History, Nature, and Mode of Application. By RICHARD ANDERSON, F.C.S., F.G.S., Member of the Society of Telegraph Engineers. London: E and F. N. Spon.

JUDGING from the long list of books and pamphlets dealing more or less with the subject of lightning conductors, and given by Mr. Anderson at the commencement and end of his work, it might be imagined that but little more could be added to the existing stock of knowledge regarding the theory and practical construction of the lightning rod; such, however, is not the case, and Mr. Anderson's excellent new book will really prove a most valuable addition not only to a scientific library but also to the library of every architect or other person concerned in the construction of every kind of building.

The amount of ignorance that exists on the subject of lightning conductors is very great; the means that have existed for obtaining information regarding the same has hitherto been equally great. No good English work, with the exception of the one now before us, has been written. This want has now been supplied, and well supplied, too.

The amount of damage effected by lightning in this country alone is very considerable, and not a year passes but we hear of a large number of buildings being struck and greatly damaged; in some cases the mischief done is irreparable. The destruction of ancient buildings inseparably connected with historical associations is in every case a deplorable disaster, and one which no amount of money will repair. Some of our finest ancient structures—Windsor Castle amongst others—are either totally or insufficiently protected from lightning, and may some day be witnesses to the folly or apathy of those to whom their preservation is practically entrusted. Every possible care is taken to protect such structures from fire, and large sums are spent for the purpose, but the few pounds necessary to erect lightning conductors are either grudged or are not expended from pure ignorance of the importance of the means of protection.

In the commencement of his work, Mr. Anderson has written in an entertaining manner an account of the early discoveries made on the subject of electricity, in the narration of which the name of the immortal Franklin is, of course, prominently noticed; how thoroughly this philsopher grasped the truth of the identity of electricity and lightning is well pointed out, and we see that from the date at which this fact was made manifest, namely, at the middle of the last century, the history of lightning conductors practically commences.

The first lightning conductor ever constructed was set up by Franklin himself at his house in Philadelphia. The spread of the system was at first slow, in Europe notably so; in many cases personal enmity checked the progress; an ignorant priesthood, which scented heresy in an attempt to draw lightning from the clouds, for a long period waged war against the heretical rods, but as time went on, and the protective effects of the rods were seen, the opposition ceased, and the disputes took the form of controversies on the proper terminations to give to the protectors, *i.e.*, whether points or balls were most effective. The controversies ran so high that they resulted in the resignation by Sir John Pringle of the Presidency of the Royal Society. Subsequent experiments proved conclusively the superiority of the pointed conductor.

In Chapter V., Mr. Anderson deals with the subject of metals as conductors of electricity, and he gives tables of the comparative values of the various metals as determined by different physicists; the want of agreement is considerable, though the superiority of copper is in all cases agreed upon.

The conductivity of the material employed for the rods is easily determined previous to the fixing of the same, but after their erection their continuity requires testing to detect faulty joints, &c.; for this purpose Mr. Anderson has designed a simple and handy instrument, which consists of a three-cell battery of low resistance, a galvanometer, and a set of three resistance coils. Five keys are attached to the apparatus; by depressing one key the battery is put through the galvanometer direct, another key closes the circuit through a known resistance, a third key interposes a higher resistance, and a fourth key inserts a resistance of a still greater value,

whilst the fifth key connects the battery and galvanometer to the terminals to which the line to be tested is connected. The galvanometer and keys are fixed to the cover of the case containing the battery and the resistance coils. The case has also sufficient space inside for a bobbin of insulated connecting wire. The whole arrangement is very portable, and well adapted for the purpose for which it is designed. The simple method of testing by comparing the resistance, whose value is to be determined, with the resistance coils, is, we think, very suitable for the purpose, and is much better than any more elaborate arrangement, such as a Wheatstone balance. Very accurate tests are not wanted, but reliable and easily made ones are, and this Mr. Anderson's arrangement undoubtedly ensures.

At the present day we imagine there are but few persons who doubt the correctness of the principle of the lightning rod; if there are any who do, the case mentioned by Mr. Anderson of the village church of Carinthia, in Austria, must convince the most incredulous. This village church was unceasingly struck in the course of the seventeenth and eighteenth centuries by lightning, which sometimes battered in the roof, sometimes broke down part of the steeple, and often flew in at the window on one side and out at the other. The lightning came again and again, and in the summer of 1780 a flash from the clouds, more violent than any preceding one, demolished the entire steeple. The Orsini family erected another steeple. But the lightning visited it as before, on the average five or six times a year, doing so much damage that the whole church had to be taken down in 1787, being found in ruins. Once more the proprietors of the village built a new church on the old ground; but this time they placed a lightning rod upon it, and no further damage ensued.

In *every* case in which a lightning conductor has failed in its purpose the result is due to faulty construction. There is *no* case on record, says Mr. Anderson, in which a really efficient lightning conductor, properly placed and with its terminal in technically so-called "good earth," did not do its duty; and, as the author most logically observes, "it may well be asserted, can no more fail to give protection than an efficient drain-pipe can fail to carry off the water upon the roof. Although," observes the author, "the electric force is neither a 'current' nor a 'fluid,' often as it is so described, still the analogy holds good so far as the one here given between the drain-pipe and the conductor. And the reason is clear enough. The water, in running down a hollow tube, obeys simply the law of gravity; but no less immutable than this is that which governs the movement of electric force. As the water has no choice but to follow the channel made for it under the guidance of experience and mathematical calculation, so has the emanation of the electric energy no option but to pursue the path which scientific investigation has shown it always to take."

(To be continued.)

International Telegraph Convention, with London Revision of Service Regulations and Tariffs, 1879. Translated by ALFRED BRASHER, 55, Parliament St. WE have received a copy of this work, which contains the Service regulations as revised by the London Conference held last year. The original text is in French, but being now translated into English by Mr. Brasher, and the whole well printed, the book is a useful reference work for all who have to deal with, or require information concerning, the subject in question.

THE ATTORNEY-GENERAL *v.* THE TELEPHONE COMPANY (LIMITED).

(Before the Lord Chief Baron and Justice Lopes.)

ON February 9th, in this case, Mr. Macrory, on behalf of the defendants, asked their lordships for liberty, on or before Wednesday, February 11th, to file affidavits in answer to those filed by the Attorney-General. There was an undertaking given that the affidavits should be filed by February 3rd. Certain negotiations were entered into which only terminated a few days ago, and pending these negotiations the defendants did not proceed with the affidavits. The negotiations had now been broken off, and the defendants asked their lordships for further time in consequence.

The Lord Chief Baron: I would merely suggest, Mr. Attorney, that, if it does not interfere with your other engagements, a case of such importance, affecting public and private rights, should be heard before us once and for all.

The Attorney-General: I am quite ready that such a course should be adopted, but I am anxious to protect myself against any accusation that I had been guilty of delay in the matter.

The Lord Chief Baron: I am sure no such accusation will be made against you, Mr. Attorney-General. You have the power to call upon us at any time to hear the cause, and we will then appoint a day for it to be heard before three judges.

The Attorney-General: These remarks will also, I apprehend, apply to the case of the Edison Telephone Company, which will stand over until all the affidavits have been filed and the evidence is completed.

The Lord Chief Baron: Certainly.

Notes.

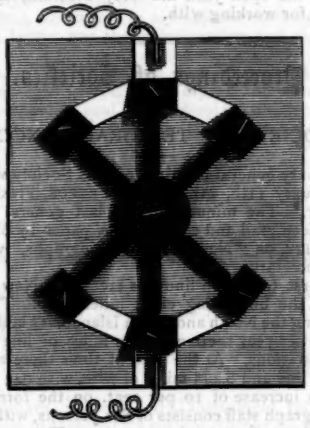
MESSRS. THEILER & SONS write us, respecting the "tapper" key described in our issue for the 15th ult. (fig. 1), that "Mr. Theiler, senior, designed two patterns of single needle tappers for Mr. Culley (then engineer-in-chief) in 1870: one in April, the other in June. The latter pattern was adopted, and Mr. Theiler subsequently (in July, 1870) put in a claim for the designing of the tappers, which was accepted and paid in due course." Thus the credit of the design would appear to be due to Mr. Theiler.

THE committee appointed by the French Minister of Public Instruction has awarded the *Prix de Volta*, 50,000 fr., to Graham Bell.

WE may mention that the General Telephone Agency Company, Limited, who are working the Gower tele-

phone in London, do so under license from the (Bell) Telephone Company.

THE GOWER TELEPHONE.—As we mentioned in our last issue, the Gower Telephone Company are to use a microphonic transmitter for working their apparatus. The arrangement of this transmitter is shown by the fig.; it consists of 6 microphones formed of 6 carbon rods, the outer ends of the latter are set in carbon blocks fixed to metal plates, to which the connecting wires are attached, as shown; the 6 inner ends rest in a single carbon block on the centre of the arrangement. The whole is secured on a wooden board against which the sound waves impinge. The system in fact differs



but very slightly from Crossley's microphonic transmitter which was described in the number of the Journal for May 1st, 1879.

A CONTRACT for laying a submarine cable across the Gulf of Mexico, connecting the United States with the Mexican Republic, has been approved by the Mexican Congress.

CAOUTCHOUC.—The German Society for the promotion of Industry offers a gold medal and £150 for a substitute for caoutchouc, and the same premium for a substitute for gutta-percha.

THE POST OFFICE AND THE TELEPHONE.—The report circulated by the *Western Morning News*, "that an arrangement has been entered into between the Post Office and Bell's Telephone Company, by which proceedings against the Company will be abandoned," is, we believe, without foundation.

IN a letter from Professor Rossetti to A. Cornu, published in *Comptes Rendus* of November 10th, 1879, occurs the following:—"The electric light includes, as is well known, two sorts of radiations—viz., the rays emitted by the incandescent carbons, and those emitted by the voltaic arc, which springs between the polar extremities of the carbons. The former give a white, the other a purple blue light; the resulting light is bluish white. The two polar extremities have temperatures very different the one from the other. The number of degrees which expresses their temperature can be deduced from the formula—

$$y = m\,T^2\,(T - \theta) - n\,(T - \theta),$$

supposing that the carbons have the maximum emissive power. The voltaic arc has very little thermal emissive power comparable to that of the pale blue flames of the Bunsen burners. Its temperature can also be obtained with the aid of the preceding formula, provided that the value of the thermal emissive power of the voltaic arc relative to its thickness be introduced. A great number of experiments have given the maximum temperature of about 3,900° C. for the positive, the temperature of about 3,150° for the negative polar extremity of the carbon. For the voltaic arc, which springs between these two extremities, the temperature was always about 4,800°, whatever the thickness of the arc and the intensity of the current."

IN a letter to the *English Mechanic* a correspondent says:—"I suppose most of the readers of this, who have to do with dynamo machines in the production of the electric light, have found a difficulty at times in overcoming the firing of the copper combs, caused often by impurity in the carbons, or faulty lamp. On one occasion, by mere accident, I found that freely chalking the revolving plates, not only stopped the local fire, but increased the steadiness of the light; and I now have these well chalked each day before starting the machine."

"DYNAMO MACHINES" *versus* "BATTERIES."—The *Scientific American* for January 31st contains an illustrated account of a system of dynamo-electric machines which are being applied by the Western Union Telegraph Company in their New York office for telegraphic purposes in the place of the ordinary batteries. "There are at present," says the journal referred to, "on the top floor of the Western Union building 14,300 gravity battery elements, and in an adjoining building there are 4,600 bichromate of potash elements, all of which are to be replaced by electric machines, and the electric current will be generated by the consumption of coal instead of zinc and acid. It is not a new idea to use machines for this purpose, but experiments in this direction, until quite recently, have not proved entirely successful. The new system of current supply, which has been adopted by the Western Union Company, has for the last few months been thoroughly tested in San Francisco, to the satisfaction of telegraph engineers and operators, and recently a set of machines have been put on trial in the battery room of the Western Union building with satisfactory results. The apparatus consists simply of a number of Siemens machines connected in series, and having their field magnets excited by a current supplied by a single Siemens dynamo-electric machine.

"All efforts formerly made in this direction sought to accomplish the object by using a single high tension machine. The potential is now obtained by connecting one commutator brush of one machine with the brush of opposite polarity of the next, and so on, and a current of any desired potential may be had by taking it off from the different machines in the series. A current taken from the first machine in the series will have a low tension; that taken from the second machine will have a higher tension, and so on.

"The electromotive force of the first machine in the series is 50 volts; in the second, 100 volts; in the third, 150 volts; in the fourth, 250 volts.

"There are three sets of the machines and engines—two sets for working the 360 wires radiating from the Western Union building and the cables of the Gold and Stock Telegraph, and one for reserve. The current is equally well adapted to the quadruplex and to the printers of the Gold and Stock Telegraph. These machines and their engines will not occupy a tenth of

the room now devoted to batteries, and a single engineer can attend them all.

"When this system is thoroughly inaugurated, the batteries will all be removed, relieving the battery room floor of a weight of 60 tons, that being the difference between the weight of the batteries and that of the new plant. The current generated by the machines is to be used for all of the purposes for which battery power is now used, such as annunciators, call bells, small motors, &c., besides working the main lines and local circuits, and in addition to this the Western Union building is to be illuminated by electricity at an early day. The Siemens machine is preferred to any other."

We may remark that a patent was taken out in this country in the year 1878 by Mr. Henry Wilde, for the application of dynamo machines to telegraphic purposes.

A correspondent of the *Athenæum* says that Dr. Schwendler, electrician to the Government of India, finds, as the result of experiment, that a current from a dynamo-electric machine is better in every respect for telegraphic purposes than the current from a galvanic battery. He produces a strong current from the machine; one portion thereof, at night, can be used as light, or in daytime may be employed in pulling punkahs, exciting currents of air, and other mechanical operations. Besides all this, weak currents may be drafted from the main current, and supplied to telegraph offices, as was demonstrated in October last, when messages were telegraphed from Calcutta to Agra, 850 miles distant. The weak signal current was obtained by tapping the current which was maintaining a powerful electric light. No diminution of the light was perceptible, the small stream tapped off being not more than ·004 of the main current. In this way a telegraph office may be lighted and supplied at the same time with signal power, and the costly and cumbersome galvanic apparatus may be got rid of.

DURING the course of 1879, three new telegraph lines have been constructed and opened for service by the Government Administration of the Persian telegraphs, viz., Recht to Enzeli, 20km.; Semnan to Firouzkouh, 70km.; and Ispahan to Kerman, 634km.; total, 724km. This extension of the system has led to the opening of ten new offices, and an increase of 13 in the number of instruments, and of 47 in new operators.

ELECTRICITY IN MINES.—M. Jutier, a French engineer, after examining the action of electricity on dynamite, has come to the conclusion that the improvements effected in the construction of machines for generating electricity, in the manufacture of conducting wires with isolating envelopes, and, above all, in that of trains, have rendered the firing of shots in mines by electricity quite practicable. They have removed the inconveniences and difficulties of detail which prevented the success of the first attempts, undertaken at a period already ancient. With the employment of dynamite, this precious auxiliary of mining works, the firing by electricity diminishes the cost of the explosions. This advantage disappears when powder is used, but it is more than compensated by the simultaneous explosion of several shots. One may return immediately, and in security, to the scene of the shots; the smoke and gas produced by the combustion of ordinary tinder are avoided. In any case this process suppresses a too frequent cause of accidents, by permitting the firing of the shots when the workmen are removed from the spot, and even when there is no one in the pit or mine. There is in that, most certainly, a most important consideration, above all when the sinking takes place in a mine where fire-damp exists.

THE New Inman Line Steamship, which is being built by the Barrow Shipbuilding Company, is to be named the *City of Rome*. It is proposed to fit her with the electric light, after the success which has attended the introduction of that light on the *City of Berlin*.

THE ELECTRIC LIGHT IN SHIPBUILDING.—Messrs. Robert Napier and Sons experimented with the electric light, during the morning and evening hours, in lighting up the new store-ship which they are at present building for the Admiralty. The test proved so satisfactory that the firm have erected a second machine and lamp for use in the building of the large new steel steamer *Parisian* for the Montreal mail service of Messrs. J. and A. Allan. Recently both lights have been in use for nearly two and a half hours in the morning and two hours in the evening. The two lights in the open yard are very brilliant, and quite sufficient for working with.

Proceedings of Societies.

THE SOCIETY OF TELEGRAPH ENGINEERS.

AN ordinary general meeting of this Society was held on February 11th, Mr. W. H. PREECE, President, in the chair. The minutes of the last general meeting having been read and confirmed, a paper by Mr. A. T. MAGINNITY, on "New Zealand Telegraphs," was read by the secretary.

The first telegraph line was erected in New Zealand in 1862, the line being eight miles long. The cable connecting the North and South Islands was laid in 1866. In the latter year there were 699 miles of line erected, with 13 stations. At the present time there are 3,345 miles of line and 8,445 miles of wire, with 943 stations, being an increase of 10 per cent. on the former year. The telegraph staff consists of 801 persons, with salaries varying from £120 to £375 a year. The engineering staff consists of 5 inspectors and 2 sub-inspectors, with 50 linemen. The duration of faults seldom exceeds one hour. Varley's brown ware insulators are used, which, however, are being largely replaced by those of white porcelain. The majority of the poles were originally earth wired, but these wires have now to a great extent been removed as they caused a considerable leakage on the lines. The instruments are chiefly sounders worked by Daniell batteries, but Fuller's batteries are being used with great success. The instruments are worked on the open-circuit system. The lines are worked wholly by the Government, but an independent railway system is being organised. Telephones are coming into extensive use, and private lines with Siemens dial instruments are also worked. A system of fire telegraphs connecting the various fire stations, police stations, and Government offices, is in operation.

In the discussion which followed the reading of the paper:—

Mr. PREECE stated that Mr. Floyd had adopted telegraph poles in New Zealand made out of old railway metals, the idea being suggested to him by a paper of Mr. David's which had been read before the Society describing the use of such metals on a telegraph line in Brazil.

A note on "The Durability of Iron Wires," was then read by Mr. W. H. PREECE.

In 1844 a line of telegraph was erected between Nine Elms and Gosport, formed of a No. 8 wire. A portion of this wire between Bishopstoke and Botley was lately removed at the author's request by Mr. Goldstone, and this specimen was exhibited to the Society. This piece was 69·33 yards long, and on being measured and tested gave the following results:—

Diameter	175 mills.
Weight	16·268 lbs.
Resistance per mile at 60° F....	12·898 ohms.
Breaking strain...	1,189 lbs.
Stretch before breaking ...	15·5 per cent.
Twists in 6 inch length before breaking...	13¼

The galvanising had entirely gone and the wire was very rusty, but in other respects, as the tests showed, the wire was in excellent condition after the 36 years' exposure.

In the discussion following the reading of the paper—

Mr. STEARNS and Mr. STROH drew attention to the brittleness of wire exposed to an impure atmosphere.

Mr. TREUENFELD said that the question of brittleness was purely a chemical one.

Mr. BELL stated that in his experience the purer the wire the better was the galvanisation and the longer would it resist the action of the weather.

Professor HUGHES stated that he had made some experiments with steel wires dipped for a minute in dilute sulphuric acid, this dipping rendered them quite brittle. With iron wire the dipping required to be as long as fifteen minutes to produce the same effect. This brittleness could be got rid of by heating the wires.

Mr. CHANDLER ROBERTS attributed the effect to absorbed hydrogen, but Professor HUGHES said that two wires plunged into water and having a current passed through them so as to generate oxygen and hydrogen gases on their surfaces did not become brittle by this process.

Mr. WILLOUGHBY SMITH stated that his experience with copper wires showed that the greater the purity the greater the durability.

A paper by Mr. A. Eden on "Morse Signalling by Magneto-Electric Currents," was then read by the secretary.

An ordinary Siemens A B C instrument transmitter was caused to transmit its currents through a relay and a high resistance, so as to cause the tongue of the relay to vibrate backwards and forwards between its stops. The transmitter was also connected to the tongue of the relay, and the stops of the latter were severally connected to the signalling keys of two circuits between Edinburgh and London. The action of the relay was thus to cause all the positive circuits to pass to one key, and all the negative to the other key, so that a rapid series of currents of each kind took the place of the battery current usually employed to work the circuits. The currents were rendered practically continuous by condensers connected in the circuits; by this means the latter were worked very satisfactorily, and demonstrated the practicability of the idea of employing magneto machines for working telegraph lines.

In the discussion which followed the reading of the paper—

Mr. PREECE pointed out that in 1865 Mr. Varley had tried Wilde's magnetic machines for working telegraph lines, and in 1872 Mr. Culley had tried the Gramme machine for a similar purpose; the experiments, however, were not satisfactory. More recently Wilde* had patented a system for effecting the same object, and Schwendler had made experiments in the same direction. In America, the Western Union Company had largely adopted magnetic machines to replace batteries, but Mr. Preece stated that to do the same in England would effect no economy, as the battery power in the Postal service was very economical, not costing one-tenth of what it did in America, where the system employed was extremely wasteful.

A paper, by Mr. C. Wilson, on "Compensating Induction in Parallel Wires," was next read by the secretary. The author observed that Professor Hughes had remarked, that Mr. Wilson's system* could only be applied to two lines; but the paper explained that it was equally adapted to three or more wires. For two wires, a condenser and resistance was placed between the two balance resistances; but, for three wires, a condenser and resistance was placed between the balance resistances of wires 1 and 2, of 1 and 3, and of 2 and 3, and so on for any number of wires.

In the discussion which followed the reading of the paper, Professor HUGHES pointed out that, for a large number of wires, Mr. Wilson's system would require a very great number of condensers and resistances. Professor AYRTON, Mr. STEARNS, Professor PERRY, and Mr. PREECE also took part in the discussion; at the conclusion of which, the usual votes of thanks being proposed and seconded, the meeting adjourned till Feb. 25th.

* See note.

THE PHYSICAL SOCIETY.

THE annual *conversazione* of this Society was held on the evening of Saturday, February 7, in King's College. The Museum of King George III., the Wheatstone Laboratory, and other halls of the college were occupied by a fine display of physical apparatus and artistic furniture, including numerous relics of Sir Charles Wheatstone. There was a large number of ladies and gentlemen present, and during the evening selections of music were played by the Musical Association of the Royal School of Mines. The apparatus was peculiar to the whole range of physical science, and was furnished in part by the college and in part by the various instrument makers and electric engineers of the metropolis. The Telephone Company and the British Electric Light Company contributed telephones and electric lamps, and Herr Faber exhibited his ingenious speaking machine.

New Patents—1880.

71. "Improvement in the apparatus or means for signalling upon, and for operating switches, signals, and other moving parts connected with lines of railway." S. J. F. DAY. (Communicated by J. S. Williams.) Dated Jan. 7.

158. "Apparatus and arrangement for telephonic and microphonic purposes." L. J. CROSSLEY. Dated Jan. 14.

203. "Improved apparatus for developing the electric light." J. CLARKE. Dated Jan. 16.

231. "Submarine electric lanterns." F. W. HENIKE and G. LANG. Dated Jan. 19.

250. "Electric lamps." J. W. SWAN. Dated Jan. 20.

296. "Electric telegraphs." W. C. BARNEY. Dated Jan. 23.

303. "Improvements in telephone signal apparatus, and in keeping clocks in unison." W. MORGAN BROWN. (Communicated by G. H. Bliss.) Dated Jan. 23.

315. "Improvements in and relating to apparatus for generating, controlling, and utilising electricity for lighting and other purposes." W. R. LAKE. (Communicated by E. J. Houston and E. Thomson.) Dated Jan. 23.

350. "Electric lamps." J. P. C. DE PUYDT, J. COUGNET. Dated Jan. 27.

351. "Improvements in telephones, parts of which improvements are also applicable to other electrical purposes." L. DAVIS. (Communicated by E. Marx, F. Aklemm, J. Kayser, and A. G. Tisdel.) Dated Jan. 27.

* *Telegraphic Journal*, July 15, 1878.

404. "Improved means and apparatus for effecting electrical connections for telephonic communication." G. WESTINGHOUSE. Dated Jan. 29.

409. "Improvements in and relating to switch apparatus for telegraphic and telephonic purposes." W. R. LAKE. (Communicated by J. A. Watson.) Dated Jan. 29.

436. "Apparatus for registering or recording telegraphic or other signals." C. Mc G. BATE. Dated Jan. 31.

455. "Lamps for electric lighting." S. H. BLAMIRES. Dated Feb. 2.

471. "Telephonic apparatus." H. H. LAKE. (Communicated by G. L. Anders and J. A. Watson.) Dated Feb. 3.

478. "Electro-magnetic and dynamo-electric machines." J. MORGAN. (Communicated by N. Glouchoff.) Dated Feb. 3.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1879.

1668. "Improvements in portable magnetic appliances, in conjunction with medicinal substances for the cure of diseases." THOMAS WELTON. Dated April 28th. 4d.

1969. "Improvements in and connected with electric light apparatus or lamps." ALFRED LONGSDON. (A communication from abroad by Alfred Krupp, of Essen.) Dated May 16th. 6d. The object of this invention is to ensure a suitable automatic periodical regulation of the distance of the carbon points or other electrodes used in electric lamps. The core of an electro-magnet is connected to a lever which is connected to the lower carbon-holder, and also by a rod or other connection to a clamping or pinching appliance or holder for the upper carbon. A spring in connection with the lever is so arranged as to counteract the force of the electro-magnet. When the circuit is complete, and the carbon points close together, the lower carbon is, by the electro-magnet, drawn down, and the upper carbon held fast by its clamp or holder, which may be an electro-magnet or an inclined piece acting against a peg, or cam, or piece which presses against the upper carbon or its holder, a helical spring tending to force the peg back. The voltaic arc now appears in its full power, but as the carbons are consumed the current is weakened; the spring at last becomes more powerful than the electro-magnet, and lifts the lever with the lower carbon, at the same time the grip on the upper carbon or its holder is released, so that the carbon drops down upon the lower carbon; the current is thereby strengthened so that the electro-magnet overpowers the spring and draws the lower carbon down, at the same time gripping the upper carbon or its holder. The regulation takes place about every three minutes, and is so quick that it is imperceptible.

1971. "Improvements in lighting by electricity." A. M. CLARK. (A communication from abroad by Nicolas Emile Reynier.) Dated May 16th. 8d. Consists of an automatic switching arrangement, by placing change lamps in a derivation of the principal current, and in inserting in the derivation appropriated to each of these lamps, except the last one, electro-magnets or solenoids, which open the derivations of the succeeding lamps when they are magnetised, and close them when they are demagnetised. (*Not proceeded with.*)

2011. "Electro-magnetic pens." JOSHUA MOSES JOSIAS. Dated May 20th. 6d. Consists of an electro-magnetic puncturing pen, with a puncturing needle and electro-magnet and battery, so that they form one compact portable instrument. Also of a suitable ink-roller for use with same.

2060. "Apparatus for electric lighting." ADAM FETTIPLACE BLANDY. Dated May 23rd. 6d. Consists of an electro-magnetic governor for regulating currents of electricity in the branches of a divided circuit, so as to permit of electric lamps being used in the said branches. The governor is formed of a piece of iron called the core, round which two or more insulated wires are wound together parallel to each other.

2111. "Electric lighting apparatus." W. R. LAKE. (A communication from Jules Puvilland and Toussaint Raphael.) Dated May 27th. 6d. This invention relates to improved electric lighting apparatus in which revolving annular carbons are employed, these carbons being of considerable length, but occupying only a small space. The said carbons revolve in proportion to the wearing away of the points between which the light is developed. An electro-magnet, traversed by a current at the entrance of the latter into the apparatus serves to produce the separation of the carbons if they come too closely together.

2199. "Improvement in lighting by electricity." ISIDOR FURSTENHAGEN. (A communication from abroad by Louis Siemens, of Charlottenburg.) Dated June 3rd. 2d. Is intended to produce a steady-burning electric light of extreme intensity, in conjunction not only with strong, but also with weak currents such as it has hitherto been impossible to utilise for illuminating purposes. In order to effect this object, a round or prismatic carbon tube is employed, through which is placed a wick, made by preference of glass or any other suitable vitreous substance which, in consequence of its being capable of evaporation in a high temperature, causes the flame-arc to be a good conductor of electricity, and to be so highly developed as to allow the intensely illuminating points of the two pieces of carbon, even when the currents are comparatively weak, to be placed at such a distance from each other as to maintain the illuminating power whilst obviating the occurrence of flickering. (*Not proceeded with.*)

2211. "Improvements in telephones." H. C. DUMONTIER. Dated June 4. 2d. Consists of a horse-shoe magnet, one face of which serves to receive the telephone, the other face, the call. This call is constructed of a magneto-electric apparatus formed of two bobbins turning in front of the magnet; the current is collected by means of a commutator, and sent into any ordinary bell arrangement. (*Not proceeded with.*)

2301. "Apparatus for electric lighting." R. WERDERMANN. Dated June 10. 6d. Consists of several modifications of Mr. Werdermann's previously-described lamp;* notably a balance adjustment of the upper carbon which is pivotted.

2322. "Electric lamps." C. D. ABEL. Dated June 11. 2d. Consists of two carbon electrodes carried by two pistons, plungers, or floats contained in two closed vessels filled with liquid in communication with each other, the relative heights of the liquid in the vessels, and the weight of the pistons and arms projecting therefrom carrying the carbons, being so proportioned that the piston carrying the upper carbon will tend to descend in its vessel, causing the liquid to flow therefrom into the other vessel, and thereby raising the second piston with the lower carbon. (*Received provisional protection only.*)

2340. "Electrodes for electric light." A. M. CLARK. (A communication from C. J. PIERRE DESNOS.) Dated June 12. 2d. Consists of carbons made cylindrical with iron or other metal rods down their centres. Also the entire surface of the electrodes are coated with a

* *Telegraphic Journal*, Nov. 15th, 1878.

material impervious to the surrounding air, incombustible, but a good conductor of electricity. *(Received provisional protection only.)*

2705. "Mariner's compasses." W. R. LAKE. (A communication from Stephen Longfellow.) Dated July 3rd. 6d. Relates to certain improvements in methods and devices for preventing the deviation of the compass needle from its proper direction caused by the effects of local attraction.

3479. "Electric signalling apparatus for railways." W. ROBINSON. Dated Aug. 29. 8d. Has for its object, chiefly, the automatic operation of electric signals on railways by means of passing trains, the rails of the track being used as principal conductors of the electric current. The track is divided into sections insulated from each other. The battery has its poles connected to the opposite rails of the track at one end of the section, the magnet which controls the operation of the signal being similarly connected at the opposite end of the section. The current from the battery keeps the magnet magnetised until a train comes on the section, when the wheels and axles, by short-circuiting, cut off the battery current from the magnet, which is thus demagnetised, and the position of the signal thereby changed, thus indicating to a following train the danger ahead. The circuit, it will be observed, is constant.

City Notes.

Old Broad Street, Feb. 12th, 1880.

ANGLO-AMERICAN TELEGRAPH COMPANY.—The ordinary general half-yearly meeting of the proprietors was held on February 6th at the City Terminus Hotel, Cannon Street, Lord MONCK, the chairman, presiding. The report stated the total receipts from the 1st July to the 31st December, 1879, including a balance of £11,300 12s. 7d. brought over from the last account, amount to £397,426 16s. 4d., being an increase in the traffic receipts, as compared with the corresponding period last year, of £91,731. The total expenses of the half-year, including income tax, repair of cables, &c., as shown by the revenue account, amount to £59,765 19s. 7d. The directors have, before declaring the net profits, set apart the sum of £140,000 to the renewal fund, leaving a balance of £197,660 16s. 9d. One quarterly interim dividend on the ordinary stock, at the rate of 6 per cent. per annum, free of income tax, was paid on 1st November last, absorbing £105,000, leaving a balance of £92,660 16s. 9d., out of which the directors recommend the proprietors to declare a final dividend of 1¼ per cent., free of income tax, amounting to £87,500, making a total distribution for the year ended the 31st December, 1879, of 5 per cent. upon the consolidated stock of the Company, 6 per cent. upon the preferred ordinary stock, and 4 per cent. upon the deferred ordinary stock; and leaving a balance of £5,160 16s. 9d. to be carried forward to the next account. The SECRETARY (Mr. John Grant) read the notice convening the meeting and the minutes of the last meeting, which were confirmed, the report being taken as read. The CHAIRMAN: "Gentlemen, the natural division of the subject which I have to bring before you coincides with that which prevails in a larger and more important annual meeting in which I took some concern yesterday—viz., it divides itself naturally into our domestic and foreign relations. With regard to our home work, the report, I think, has made it pretty plain that I have no need to tell you that it is eminently satisfactory. Your property is in a good condition, and your cables are working with their usual efficiency. Your income has, as you will observe, very largely increased within the last half-year, as compared either with the preceding half-year or with the corresponding half of the preceding year. We propose, as we stated at the last half-yearly meeting, to lay down a new cable this year between Ireland and America, and we have the pleasure to tell you that we are in a position to do that without asking you or the public for a farthing of the money. (Applause.) We propose, in addition to that, to lay down or to renew, as you will observe by the report, other portions of our system which have either worn out or become inefficient—I mean short cables connecting the island of Newfoundland with the continental portion of America, and this work it is absolutely necessary should be done in order to maintain the efficiency of our system. We propose to do that also out of the money in hand. Gentlemen, there were some doubts expressed at the last meeting, I think, about the propriety of laying down a new cable between Ireland and America this year. The argument used, as I recollect it, was that when a cable gets to the bottom of the sea it more or less deteriorates in quality, and therefore the longer, consistently with the efficient performance of your work, you can put off laying down a new cable the better. Well, now, gentlemen, no one is more ready than I am to admit the general soundness of that argument, but it must be taken with certain qualifications. In the first instance, the enormous increase of your traffic has rendered it absolutely necessary that you should keep at least three cables in full working. (Applause.) Our three cables are working and each performing their full share of work, but we must recollect that one of these cables is very nearly eleven years old, and without any disparagement to its condition we must be prepared for contingencies. (Hear, hear.) I will go no further than that. Gentlemen, there is another view of the matter, and my allusion to it shall be very short—viz., our foreign relations—and by that I mean to express what you are all aware of, that a cable has been laid down by a new French company. Now, gentlemen, the result of that will be a competition. A competition as, I understand, and as we have already announced, can only be carried on by a very considerable reduction of tariff. A very considerable reduction of tariff means nothing more than a very considerable increase of traffic, and in order to carry that increase of traffic, with a reduced tariff, as efficiently as you have done hitherto, you must be prepared with additional instruments for the working of the traffic. There is another view of the matter; sooner or later it must come to an arrangement, and the basis of that arrangement will depend mainly on the number of efficient cables, and our share of the profits arising out of that arrangement will depend very materially on the number of efficient cables that we shall have when that arrangement is made. (Applause.) I think, gentlemen, I need not trouble you further on that point, because I am pleased, from the indications of assent which I hear from all parts of the room, to find that you are convinced that we ought at once to exercise the power we have of laying down a new cable. (Applause.) We have made arrangements, or arrangements are in progress, for a new survey of the bed of the Atlantic, so as to obtain, if possible, a better resting-place for our new cable than has been afforded to those which have preceded it; a gentleman whom I see here also suggested that we should make experiments with reference to the coating of the cables. We have been engaged in that too, and we are in great hopes, from the turn things have taken and the result of the experiments we have made, that we shall be able to get a class of cable which will more effectually resist the deterioration of

whatever influences may be brought to bear upon it under the water than many that have yet been laid down. In fact, I may say, once for all, that with reference to this new cable we are doing everything we can to get the highest intrinsic security in the cable itself, and the best possible bed for it in the bottom of the Atlantic." The Chairman concluded by moving the adoption of the report. Sir DANIEL GOOCH seconded the resolution. The CHAIRMAN, in reply to shareholders, said that with regard to the reserve fund the powers given were unlimited, but the board had no notion of maintaining the contribution which had been made this half-year. It was an exceptional case, as they should have the very large outgoings he had already referred to. They had had very good reasons for not publishing the usual traffic returns, but they need not be in the least alarmed, as the traffic for January had amounted to a very tidy sum. (Applause.) Mr. Newton had referred to a monopoly, but he could assure the meeting that the Company had never had such a thing. (Hear, hear.) There had been an undertaking from the British Post Office, and a concession from the French Government, giving them any messages not directed to go by any other cable, and that monopoly, if it were one, had not been infringed in the slightest degree. Mr. Newton had asked why they did not make use of the advantages at their disposal by carrying messages at a low rate, and allowing their partner, the Direct Company, to carry special messages at a high rate? It would perhaps surprise him to hear that that was precisely the arrangement they had made. (Applause.) The "caving in" was not on their side. He had only said that these people had come and offered certain terms. As he had already said, these negotiations were still in progress, and the matter had better be left at present in the hands of the board. (Applause.) If it were possible, without prejudice to the interests of the company, to put the meeting in possession of what had taken place, they would find that, so far from having "caved in," they were as safe as they could possibly desire. (Applause.) The Chairman then put the resolution, when it was carried unanimously. The retiring directors, Messrs. F. A. Bevan and L. M. Rate, were next re-elected. The auditors, Messrs. Joshua Dean and Francis Glass, were also re-appointed. Cordial votes of thanks were then passed to the Chairman, Board of Directors and officers of the company, and the meeting separated.

THE INDIA RUBBER, GUTTA PERCHA, AND TELEGRAPH WORKS COMPANY, LIMITED.—The report of the directors of this Company, for the year ending December 31, 1879, presented at the sixteenth ordinary general meeting of shareholders, held as we go to press, states that the accounts show the result of the Company's operations for the past year—a result which the directors consider satisfactory. After deducting working expenses, depreciations, and bad debts, the net profit for the year is £52,354 5s. 8d. Adding to this £9,048 18s. 3d. brought forward from 1878 and £1,175 premium on new shares, and deducting £15,600 interim dividend paid in August and £2,100 written off shares in hand, there remains a disposable balance of £44,878 3s. 11d. Of this balance the directors have added £25,000 to the reserve fund, raising it to £50,000; and they recommend the distribution of £15,600 in dividend for the last half-year, being at the rate of ten per cent. per annum, free of income tax, carrying forward £4,278 3s. 11d. to the credit of the current year. The interest on the Company's debentures and loans is moderate, and is more than met by the interest received on debentures and shares held. The new 6 per cent. debentures issued last March were all readily taken. The year's sales compare favourably with those of 1878. The Company's steamships have been well employed, the *Dacia* principally in laying the new cable of 500 miles from Marseilles to Algiers, manufactured by the Company for the French Government, and completed in October. Several smaller cable contracts have also been carried out during the year. Mr. Silver and Mr. Bannatyne, who retire by rotation, offer themselves for re-election as directors.

THE CUBA SUBMARINE TELEGRAPH COMPANY, LIMITED.—The report of the directors for the half-year ending 31st December, 1879, to be presented at the ordinary general meeting of shareholders to be held at the offices of the Company, on the 18th day of February, 1880, states that the gross receipts, including the balance brought from last account, amount to £19,972 15s. 10d., and the gross expenditure to £7,556 1s. 8d., leaving a sum of £12,416 14s. 2d. to the credit of revenue account. In the above amount of £7,556 1s. 8d. is included, however, the sum of £3,942 14s. 3d., the cost of the repair of the Cienfuegos-Santiago section of the original cable, and of the cutting out of the fault in and other repairs to the India-rubber (duplicate) cable, the ordinary expenses being £3,613 7s. 5d. The sum of £3,500 has been added to the reserve fund, increasing that fund to £27,086 10s. 7d. The balance of revenue, after providing for the dividend on the preference shares, will admit of a dividend on the ordinary shares at the rate of 6 per cent. per annum, leaving the sum of £1,116 14s. 2d. to be carried forward to the current half-year's account, and the Board recommend that dividends be declared accordingly, payable 19th instant.

THE TELEGRAPH CONSTRUCTION AND MAINTENANCE COMPANY (Limited) notify that, subject to the audit of the accounts, the directors propose paying a dividend of 15 per cent. (£1 16s.) per share, in addition to the ad-interim dividend of 5 per cent. already paid, making 20 per cent. for the year 1879.

The following are the final quotations of telegraphs for Feb. 12th:—Anglo-American, Limited, 62½-62¾; Ditto, Preferred, 88½-89½; Ditto, Deferred, 36¼-36¾; Brazilian Submarine, Limited, 7¾-8¼; Cuba, Limited, 9-9½; Cuba, Limited, 10 per cent. Preference, 16½-17; Direct Spanish, Limited, 2-2½; Direct Spanish, 10 per cent. Preference, 11¼-11¾; Direct United States Cable, Limited, 1877, 11⅜-11⅝; Eastern, Limited, 9-9¼; Eastern 6 per cent. Preference, 11¼-12½; Eastern, 6 per cent. Debentures, repayable Oct., 1883, 103-106; Eastern 5 per cent. Debentures, repayable Aug., 1878, 101-103; Eastern, 5 per cent., repayable Aug., 1899, 102-104; Eastern Extension, Australasian and China, Limited, 9-9¼; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 104-107; 5 per cent. Australian Gov. Subsidy Deb. Scrip, 1900, 100-102; Ditto, registered, repayable 1900, 101-103; German Union Telegraph and Trust, 8½-9; Globe Telegraph and Trust, Limited, 5¼-5⅞; Globe, 6 per cent. Preference, 11⅛-11½; Great Northern, 9¼-9⅝; Indo-European, Limited, 24-26; Mediterranean Extension, Limited, 3-3½; Mediterranean Extension, 8 per cent. Preference, 10¼-11¼; Reuter's Limited, 10-11; Submarine, 235-245; Submarine Scrip, 2¼-2⅝; West Coast of America, Limited, 2-2½; West India and Panama, Limited, 1⅝-2¼; Ditto, 6 per cent. First Preference, 7⅛-8¼; Ditto, ditto, Second Preference, 7-7½; Western and Brazilian, Limited, 7¾-8; Ditto, 6 per cent. Debentures "A," 98-101, Ditto, ditto, ditto, "B," 97-100; Western Union of U. S. 7 per cent., 1 Mortgage (Building) Bonds, 120-125; Ditto, 6 per cent. Sterling Bonds, 105-107; Telegraph Construction and Maintenance, Limited, 36-37; Ditto, 6 per cent. Bonds, 104-108; Ditto, Second Bonus Trust Certificates, 3-3½; India Rubber Co., 14-14½; Ditto, 6 per cent. Debenture, 106-108.